

# Technique for Percutaneous Needle Biopsy of Bone and Marrow

LUIS FELIPE FAJARDO, M.D., *Stanford*, AND  
HERNANDO SARASTI, M.D., *Bogotá, Colombia*

THE INDICATIONS FOR BONE MARROW aspiration are well known, and the need for bone marrow specimens obtained by excision instead of—or in addition to—aspiration is also well recognized. Rather than using the conventional open bone and marrow excision of biopsy specimens, more and more institutions are relying on obtaining the specimens percutaneously, which does not require operating room facilities.<sup>1-4</sup> Percutaneous bone and marrow sampling is currently used in the staging of lymphomas in Stanford Medical Center. It will be used more often as patients with other tumors, metabolic bone disease, and the like are more extensively evaluated.<sup>5</sup>

There are several instruments designed or adapted for this type of procedure.<sup>6-12</sup> One that has been gaining in popularity is the modified, large, Vim-Silverman needle (Westerman-Jensen model).<sup>1,2,3</sup> This is a satisfactory instrument, but many physicians are not familiar with it. Unfortunately we have not found a description of the technique that illustrates, with sufficient detail, the proper handling of needle and specimen.

The following method, which includes our modifications, has been used for several hundred biopsies carried out at San Juan de Dios, and Central Military Hospitals in Bogotá, Colombia, and at the Stanford University Hospital and its affiliated Veterans Administration Hospital of Palo Alto, California. This procedure has not resulted in any serious complications in more than 200 patients observed between one week

and one year after biopsy. Emphasis will be made on those steps of the method where errors have been noticed most often.

## Technique

The needle\* used consists of the following parts: (Figure 1)

- A. Needle shaft with beveled tip. Luer lock fits into B.
- B. Needle obturator.
- C. Cutting blades, with inner bevel. This is the most delicate part of the instrument.
- D. Blades' stylet (used for ejection of specimen).

This biopsy method can be carried out at the patient's bed or in a physician's office. A half hour before the procedure, adult patients are given 50 mg of meperidine hydrochloride (Demerol®) intramuscularly. To assure his cooperation and to decrease his anxiety the patient must be told that the procedure is innocuous, although it may cause slight discomfort.

Most biopsy specimens have been obtained from the posterior and superior iliac spine, and the best position for an adult is the lateral decubitus. Individual circumstances may demand the sampling of other areas with abundant cancellous bone, such as the anterior iliac spine, but we do not recommend the use of this needle in the sternum. The technique used in children has been described by Pearson, McFarland and Cone.<sup>13</sup>

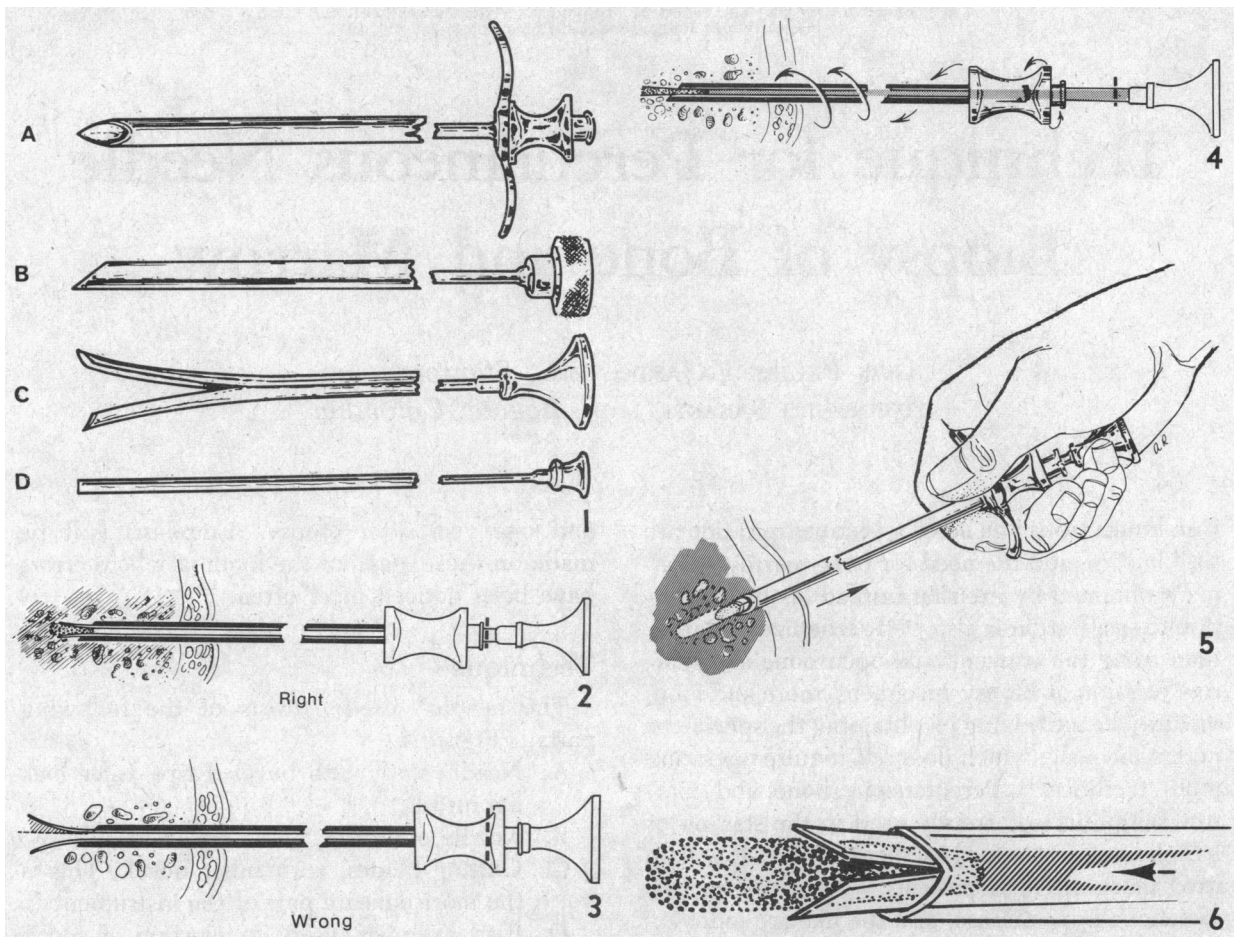
Flexion of the corresponding limb helps to determine by palpation the position of the bone

Associate Professor of Pathology, Stanford University School of Medicine, and Pathologist, Veterans Administration Hospital, Palo Alto (Fajardo); Professor of Medicine, Universidad del Rosario, Bogotá, Colombia (Sarasti).

Submitted September 29, 1971.

Reprint requests to: L. F. Fajardo, M.D., Department of Pathology, Stanford University School of Medicine, Stanford, Ca. 94305.

\*Large needle for bone and marrow biopsy (W-J model), Division of Special Needles, Becton-Dickinson Co., Rutherford, N.J.



**Figure 1.**—Components of needle used in percutaneous excision of bone and marrow are shown in frame 1. The right and wrong depth of penetration of blades are shown in 2 and 3. Frame 4 illustrates the incomplete clockwise-counterclockwise rotation that is used in sliding the needle shaft down around the blades to grasp the specimen for withdrawal. Withdrawal (shown at 5) is carried out with the shaft kept close to the tip of the blades lest the specimen be damaged or lost. A slight clockwise-counterclockwise rotation facilitates extraction. The specimen is pushed out with the blades stylet (as shown at 6) onto a glass slide, where it is smeared before fixation.—Illustrations by Albert Rendes.

prominence. A small amount of 2 percent lidocaine hydrochloride (Xylocaine) without epinephrine is injected with a 22-gauge needle intradermally and at several points of the periosteum in, and immediately around, the area chosen for biopsy. A 5 mm longitudinal incision of skin is made with a No. 11 Bard-Parker blade.

The assembled needle (A and B) is inserted until it touches the bone. Then it is introduced into the bone with a clockwise-counterclockwise rotary motion. This step may require considerable pressure if the bone cortex is thick. To avoid lateral slipping of the needle and a useless biopsy of cortical tissue, it is necessary to keep the needle perpendicular to the bone surface. When it has penetrated through the cortex, the

needle is firmly supported by the bone and does not need to be hand held. Only then can the next step be carried out.

The obturator (B in Figure 1) is unlocked, removed and replaced by the blades (C). This step is easier if the blades are inserted with their stylet (D), which is then removed.

Then the blades are introduced into the bone, *without rotation* and not more than 1 cm beyond the tip of the needle (see 2 in Figure 1). To assure that this length is not exceeded, a mark is etched on the surface of the blade (see broken line in illustrations 2, 3 and 4) where it can be kept in view and the depth of penetration gauged thereby. Penetration of the total length of the blades results in outward bending and damage of the

instrument (see 3 in Figure 1); also the large bone "bite" cannot be removed. Gentle tapping with a mallet provides fast and accurate penetration.

Leaving the blades in place, the needle shaft is introduced around them by incomplete, clockwise-counterclockwise rotation (see 4 in Figure 1). The specimen is being cut free at this time and penetration of the needle shaft does not need to be more than 1 cm (that is, to the tip of the blades). Again, the blades *should not be rotated*.

The needle, now containing blades and specimen, is removed as a single piece—that is, avoiding displacement between shaft and blades, which could result in damage or loss of specimen (see 5 in Figure 1). This extraction is better accomplished by minimal clockwise-counterclockwise rotation.

The specimen is pushed out with the blades stylet (6 in Figure 1) onto a glass slide. Attempts to pull the sample with the blades *through* the needle will result in distortion of tissue. The sample generally is a cylindroid of cancellous bone, up to 20 mm long, with a maximum diameter of 3 mm. Marrow is easily seen.

Satisfactory prints for cytologic examination are obtained by gently rolling the specimen on glass slides. Also good fragments of bone marrow can be scraped promptly from the inner surface of the blades and smeared. Thus, cytologic and histologic preparations can be secured from the specimen.

Serious histologic artefacts will occur in biopsy specimens obtained immediately after bone marrow aspiration of the same area. However, if aspiration is indicated it may be performed after the biopsy: a conventional bone marrow needle is inserted through the already anesthetized skin and periosteum, at a different angle in order to avoid the area of the biopsy.

After bacteriologic (if necessary) and cytologic preparations are completed, the specimen is immersed in Zenker's fixative<sup>14</sup> without acetic acid for two to four hours. Initially, we used fixation in 10 percent neutral formaldehyde, which was not as satisfactory. Bouin's fixative gives good results, but limits the range of staining procedures. After fixation, decalcification of this small specimen is accomplished generally in 30 minutes with 5 percent nitric acid solution (never more than one hour for normal cancellous bone). After a short period of washing in tap water the tissue

is processed as usual for paraffin embedding. Longitudinal sections are stained in each case with hematoxylin and eosin, and for iron (Gomori's method).<sup>14</sup> Eosin stain is light, so differentiation between neutrophilic and eosinophilic granulocytes is easy. Many other stains, for collagen, reticulum, micro-organisms, etc., are performed according to the individual case.

As soon as the needle is removed, an assistant applies continuous pressure in the area with a gauze pack for five minutes. Afterward, a thick pack of gauze is left in place for 24 hours, supported by a wide strip of adhesive tape which must cover more than one-half of the pelvic girdle. Suture of the incision is not necessary.

This needle requires little maintenance, beyond careful cleaning immediately after each use. Sharpening of the cutting blades may be necessary from time to time. One of our first needles was used for more than 100 specimens before reconditioning was needed.

## Indications

The following is a list of the indications for percutaneous needle biopsy of bone and marrow as compiled from our own experience<sup>2</sup> and a brief review of the literature.<sup>3,4,5,7,9,11,15,16</sup>

- Investigation of unsuccessful bone marrow aspiration ("dry tap").
- Diagnosis of myelofibrosis or osteosclerosis.
- Diagnosis of bone marrow hypoplasia or aplasia.
- Diagnosis or Staging of
 

{	Primary or metastatic tumors of bone marrow (leukemia, lymphoma, plasmacytoma, carcinoma, and the like). Infectious diseases (tuberculosis, mycosis, etc.). Reticuloendothelioses (histiocytosis X, Gaucher's disease, etc.)
---	--
- Study of metabolic bone disease.
- Follow-up of any of above conditions.

## REFERENCES

1. Westerman MP, Sachs M, Jensen WN: Bone marrow biopsy: Evaluation. Clin Res 8:219, 1960
2. Sarasti H, Fajardo LF, Santamaría A, et al: Biopsia percutánea de medula ósea. Análisis de 117 muestras. IV—Latin American Congress of Pathology (San Salvador, El Salvador), Dec 1963
3. Ellis LD, Jensen WN, Westerman MP: Needle biopsy of bone and marrow. Arch Intern Med 114:213-221, 1964
4. Burney SW: Bone-marrow examination—Technique and diagnostic value of a bone-marrow biopsy using a Silverman needle. JAMA 193: 859, 1966

5. Hansen HH, Muggia FM, Selawry OS: Bone-marrow examination in 100 consecutive patients with bronchogenic carcinoma. *Lancet* 2:443-445, 1971
6. Sacker LS, Nordin BEC: A simple bone biopsy needle. *Lancet* 1:347, 1954
7. McFarland W, Dameshek W: Biopsy of bone marrow with the Vim-Silverman needle. *JAMA* 166:1464-1466, 1958
8. Conrad ME, Crosby WH: Bone marrow biopsy: Modification of the Vim-Silverman needle. *J Lab Clin Med* 57:642, 1961
9. Burkhardt R: Technical improvement and application of histobio-psy in bone marrow and bones. *Klin Wochenschr* 44:326-334, 1966
10. Helal B: New bone needle. *Br Med J* 4:415, 1967
11. Barkve H: Needle biopsy of bone marrow—Experiences of 200 biopsies. *T Norsk Laegeforen* 88:2182-2186, 1968
12. Hanafsee WN, Tobin PL: Closed bone biopsy by a radiologist. *Radiology* 92:603-606, 1969
13. Pearson HA, McFarland W, Cone TE: Biopsy of bone marrow with the Silverman needle in children. *Pediatrics* 26:310-314, 1960
14. Luna LG (Ed): *Manual of Histologic Staining Methods of the Armed Forces Institute of Pathology*. New York, McGraw-Hill, 1968, pp 4-179
15. Weisberger AS: Significance of "dry tap" bone marrow aspirations. *Am J Med Sci* 229:63-68, 1955
16. Sarasti H: Aplastic anemia, *In* Restrepo A (Ed): *Hematología Clínica*, Vol 1, 1st Ed. Sociedad Colombiana de Hematología, Bogotá, 1968, p 103

## California Medicine FOR TOMORROW'S PHYSICIAN

Just fill out this blank and mail it to CALIFORNIA MEDICINE, Circulation Department, 693 Sutter Street, San Francisco, California 94102.

Donor (please print your name and address): \_\_\_\_\_  
Name

\_\_\_\_\_  
Address City Zip

Recipient\* (Please supply name and address if you wish to specify a particular one. If you'd like to have us take a name at random from student rolls, just write "Random.")

1. \_\_\_\_\_  
Name (or "Random") Address City Zip School and Year

2. \_\_\_\_\_  
Name (or "Random") Address City Zip School and Year

☐ Enclosed is my check\* (\$4 per subscription)

*If you wish to write personally to the recipient, telling him of your gift, please check here ☐. If not, we will send a note, telling the student that he is receiving CALIFORNIA MEDICINE as a gift from you.*

\*When the recipient's name is supplied by you, your donation is not tax-deductible and your check should be made payable to California Medical Association. If you direct that a student's name be picked at random, the amount is deductible and your check should be drawn to CMRF—Student Subscription.